

Physiological and biochemical strategies for relentless productivity by building tolerance in crop plants under abiotic stresses

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Abstract

Sustained self-sufficiency and marches towards food and nutritional security depend on crop improvement in rapidly limiting natural resources. Besides cereals, pulse production now needs understanding of intricate physiology by utilizing judiciously devised cutting edge technologies and consequently to develop climate resilient desirable genotypes with breeders and biotechnologists for relentlessly enhanced productivity. Abiotic stresses are drought, salinity, heat and flooding affect photosynthesis, nitrogen assimilation, protein synthesis, pollination and fertilization. In our experiments, seed hardened and foliage applied Salicylic Acid (SA) significantly alleviated salinity and drought in pea and chickpea, respectively; brassinolide and micronutrient zinc individually mitigated salinity, whereas paclobutrazol alleviated harmful effects of flash flooding in mung bean by producing aerial roots with initiating parenchymatous tissue in roots. SA at 1.0 to 1.5 mM; brassinolide at 0.05 mM and paclobutrazol at 10 ppm provided protection against stresses (drought, salinity, heat and flash flooding) at critical developmental stages of seedling growth, reproduction (pollen formation, pollen, germination, fertilization) and seed development. Encouraging findings regarding SA induced micronutrients uptake with improved cellular metabolism through improved water use efficiency, enhanced anti-oxidative enzymes activity and synthesis of antioxidants of compatible nature under abiotic stresses were recorded, which helped in elucidating the underlying mechanisms for tolerance in crop plants. It can be concluded that stress tolerance may be achieved by the maintenance, activation and enhanced function of physiological systems that are especially sensitive to disruption by increased levels of stress. Information on stress-inducible genes, genetic control of stress responses and signaling pathways offer a chance for creating a clearer picture of plant responses and adaptations to different stresses.

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